

Chapter 1

Chemistry Defines Medicine

Throughout history, medicine has often been portrayed as a mysterious art — something distinct from the material world. Yet, beneath every healing remedy and every biological function lies the same universal reality: matter governed by chemistry. Whether within the body or inside a laboratory flask, the same elements combine, react, and transform according to immutable natural laws.

Therefore, before discussing medicine, it is essential to grasp what chemicals truly are, for without them, neither life nor medicine could exist.

What Are Chemicals?

At the foundation are **elements**, each with a name and symbol. Carbon is “C,” Oxygen “O,” Nitrogen “N,” Phosphorus “P,” Calcium “Ca,” Iron, “Fe (from Latin name Ferrum), and so on. These elements exist in nature, have been well isolated, and are carefully characterized in reference to established standards.

Most substances we encounter are not single elements but combinations of them, known as **molecules** or **compounds**. For example, oxygen is represented by the symbol “O,” and water is represented as H_2O . However, the oxygen we breathe in the air

is not a single atom but a molecule made of two atoms joined together, written as O_2 .

The representation of joined atoms is referred to as **bonds**. Bonds can be single, double, triple, and represented by lines. These bonds determine the properties of molecules. For instance, oxygen gas is shown as $O=O$, with a double bond represented by two lines.

Another Example: Sugar

Consider sugar, derived from sugar cane. Its chemical formula is often given as $C_{12}H_{22}O_{11}$. When broken down with the addition of water (H_2O), sugar yields two simpler components—glucose and fructose—both with the same ratio of atoms ($C_6H_{12}O_6$). If the atomic composition is the same, why two names?

The difference lies in **how the atoms are connected**—their bonding arrangement, or what chemists call **structure**. Glucose and fructose are “isomers”: same atoms, different arrangements. Determining these structures requires advanced techniques, such as X-ray crystallography and nuclear magnetic resonance (NMR) spectroscopy.

Representations vs. Reality

The key point is this: chemical formulas and structural diagrams are representations of reality. They summarize properties, behaviors, and relationships of molecules, not literal images of the substances themselves. These structures are often not seen directly with the naked eye or even with a microscope—they are models based on careful observations and experimental testing, representing the behaviors of the molecules.

Chemistry is not fiction; it is the language used to describe and predict the behavior of matter. To confuse chemical diagrams with cartoons is to misunderstand their purpose. They are not

decorative drawings, but essential tools to represent how substances function in the real world.

In short, **chemicals are the basic, fundamental building blocks of the universe**. They make up everything—biological entities such as humans, animals, plants, and microorganisms, as well as all other substances, including medicines, pharmaceutical products, nutritional ingredients, and supplements.

The study of these substances falls under the discipline of **chemistry**, a core branch of true science. Chemistry is closely linked to **physics**, which explores the atomic and subatomic world, including electrons, protons, neutrons, and their interactions and behavior. Together, physics and chemistry provide the foundation for understanding matter and life itself, and are considered a science.

So, if someone claims to study science—or to be a scientist—they must recognize that their work is fundamentally rooted in one or both of the core disciplines: **physics and chemistry**. Without engaging experimentally with these foundations, it is merely applied science, or worse, a deviation masquerading as science.

This is where medicine, pharmaceuticals, nutrition, and biology often fall short. They are all inseparably linked to the science of chemicals—namely, **chemistry**—yet many practitioners in these fields operate with little or no true grounding in it. Physicians, for example, may prescribe drugs daily but often have only a superficial understanding of their chemical nature, testing, or behavior in the body. The result is that they defer to institutional claims or ready-made narratives rather than explaining them scientifically.

However, physicians and other medical experts are often recognized as scientific authorities and granted substantial funding and influence to promote what they call “medical” and “pharmaceutical” science. As a result, problems are often exacerbated,

beginning with improper disease diagnosis (testing) and followed by inappropriate treatments.

To understand the science in these domains, there is no alternative: one must have a solid grasp of chemistry. Without it, “science” becomes a matter of authority, not evidence.